In the Drawings

The drawings have been amended to denote Figure 1 as prior art. This amendment is reflected on the Replacement Sheet attached as an appendix hereto.

Remarks/Arguments

The specification has been amended in response to the non-final Office action. Specifically, a new Abstract is being submitted on a separate sheet attached as an appendix hereto. Further, section headings have been added to the specification, and the specification has also been amended to include a brief description of Figure 1.

The claims have likewise been amended in response to the Office action and to more clearly reflect the present invention. In addition, claim 10 has been added to include limitation omitted from claim 2. Even in light of these amendments, no new matter has been added. It would be appreciated if the Examiner would indicate the acceptance of this amendment in the next office communication.

Specification

The Examiner is requiring a new Abstract. In response, a new, amended Abstract is being submitted on a separate sheet attached as an appendix hereto.

The Examiner has also objected to the specification because

it did not contain section headings. Accordingly, the specification has been amended to include section headings, and thus, withdrawal of this objection is respectfully requested.

Claim Objections

The Examiner objected to claims 1 and 3 because the claimed ranges were indefinite. Accordingly, these claims have been amended to clearly set forth the claimed ranges. The Examiner also objected to claims 7 and 8 for lacking certain antecedent bases. Claims 7 and 8 have likewise been amended to include proper antecedent bases for the claim terms set forth therein. In light of these amendments, withdrawal of the objection to these claims is respectfully requested.

Claim Rejections - 35 USC § 112

The Examiner has rejected claim 2 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention. Specifically, the Examiner rejected claim 2 because it included a broad range together with a narrow range that falls within the broad range. Accordingly, claim 2 has been amended to only recite the broad range, and new claim 10, which depends from claim 2, sets forth the narrow

range. Since claim 2 has been amended to only include a single range, withdrawal of this rejection is respectfully submitted.

Claim Rejections - 35 USC § 103

Claims 1-3 and 9

The Examiner has rejected claims 1-3 and 9 under 35 U.S.C. § 103(a) as being unpatentable over Kaplan (US 1,509,653) in view of Ferleger (US 5,352,092). However, the Examiner has not met his burden of establishing a prima facie case of obviousness because the combined teachings of the Kaplan and Ferleger references do not teach or suggest every claim limitation of claims 1 and 9 and those claims depending therefrom. Thus, for the reasons set forth below, withdrawal of this rejection is respectfully requested.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference or combination of prior art references, must teach or suggest all the claim limitations.

In this case, the combined teachings of the Kaplan and Ferleger references do not teach or suggest every claim limitation. Specifically, both the Kaplan and Ferleger references lack a teaching of a ratio of a maximum thickness of each blade to an average developed length of an average fibre of each blade between 0.1 and 0.2. Further, the references also do not disclose a blade having an average fibre that is oriented, over essentially an entire height of the leading edge, along a straight line so as to form an angle greater than 90° relative to a line (U) defining a direction of rotation of the leading edge of the runner. Since the combined teachings of the Kaplan and Ferleger references do not teach or suggest at least these claim limitations, as discussed in detail below, withdrawal of this rejection is respectfully submitted.

First, with regard to the Kaplan reference, this reference does not disclose the claimed ratio and claimed angle required at least by independent claims 1 and 9. According to the Examiner, the Kaplan reference does not teach a Francis runner having ratio of the maximum thickness of each blade to the average developed length of the average fiber of each blade between 0.1 and 0.2. Thus, the Kaplan reference clearly lacks this claim limitation.

Not only does Kaplan lack a teaching of the claimed ratio, but it also lacks a teaching of a blade having an average fibre that is oriented, over essentially an entire height of the leading edge, along a straight line so as to form an angle greater than 90° relative to a line (U) defining a direction of rotation of the leading edge of the runner, as also required by at least claims 1 and 9. At first blush, Kaplan might appear to teach such an angle β that is greater than 90°, as shown in Figure 6. However, this angle β cannot correspond to the claimed angle. As set forth in the specification of the Kaplan reference, a runner axis is denoted as z-z and shown in Figures 1, 3, and 5. A stream surface s-s is also shown in these Figures. In light of the runner axis, the stream surface s-s is taken along a *thickness* of each blade. Thus, Figure 6, which is taken along the stream surface s-s of Figure 5, actually depicts the cross-sections of two adjacent blades along the *thickness* of each blade. Subsequently, the angle β represents the inlet angle between a tangent t of a center blade-section-line (α-α) along the *thickness* of the blade and a trajectory.

In contrast, the present application claims an angle α, which represents the angle between a linear speed of advance (U) and a straight line (Δ) extending from an average fiber (M).

Like the Kaplan reference, the present application teaches a runner 1 having a central axis X-X', and this axis is shown in Figures 1, 2, and 3. As shown in Figure 3, in light of the position of the central axis X-X', the angle α represents the angle between a line Δ taken along the *length* of a blade A and a line U defining a direction of rotation of a leading edge 21 of a runner 1. Thus, the claimed angle α is in an entirely different plane than the angle β disclosed in the Kaplan reference, as evinced by the relative positions of the angle and the runner axis in the present application and the Kaplan reference. Accordingly, the Kaplan references lacks a teaching of a blade having an average fibre that is oriented, over essentially an entire height of the leading edge, along a straight line so as to form an angle greater than 90° relative to a line (U) defining a direction of rotation of the leading edge of the runner, as well as a teaching of a ratio of the maximum thickness of each blade to the average developed length of the average fiber of each blade that is between 0.1 and 0.2, as required by at least independent claims 1 and 9.

Second, like the Kaplan reference, the Ferleger reference also does not disclose the claimed ratio and claimed angle. With regard to the ratio, the claimed ratio is the ratio between a

maximum thickness of each blade to an average developed length of the average fiber of each blade. As set forth in the specification of the present application, the maximum thickness of a blade is denoted as "e" in Figures 3 and 4. Further, the average developed length of the average fiber is defined as the half-sum of the length of an average fiber M at a level of a crown 3 and at a band 4 and is denoted as "L" is Figure 3. While the Ferleger reference does disclose many airfoil parameters in Figures 2 and 6 and Tables I and IA, such as pitch P and width W, Ferleger does not teach any parameters comparable to the maximum thickness e and average developed length L defined in the present application. Since Ferleger does not teach these measurements, it subsequently does not disclose a ratio between these parameters. Thus, Ferleger does not teach a Francis runner having a ratio of the maximum thickness of each blade to the average developed length of the average fiber of each blade between 0.1 and 0.2.

Not only does Ferleger lack a teaching of the claimed ratio, Ferleger also does not disclose the claimed angle. As previously stated, the claimed angle α represents the angle between a lin (U) and a straight line (Δ) extending from an average fiber (M). Again, while the Ferleger reference does disclose many airfoil

parameters in Figures 2 and 6 and Tables I and IA, Ferleger does not teach any parameters comparable to the line (U) defining a direction of rotation of the leading edge of the runner and the straight line (Δ) extending from the average fiber (M) of a blade (A). Since Ferleger does not teach these parameters, it subsequently does not disclose an angle between these elements. Thus, Ferleger does not teach a a blade having an average fibre that is oriented, over essentially an entire height of the leading edge, along a straight line so as to form an angle greater than 90° relative to a line (U) defining a direction of rotation of the leading edge of the runner.

Since neither the Kaplan reference nor the Ferleger reference teaches a ratio of a maximum thickness of each blade to an average developed length of an average fibre of each blade between 0.1 and 0.2, nor a blade having an average fibre that is oriented, over essentially an entire height of the leading edge, along a straight line so as to form an angle greater than 90° relative to a line (U) defining a direction of rotation of the leading edge of the runner, the combined teachings of these references do not disclose every claim limitation of at least independent claims 1 and 9. Thus, withdrawal of the rejection of these claims and those claims depending therefrom is respectfully

requested.

Claims 4, 5, and 7

The Examiner has rejected claims 4, 5, and 7 as being unpatentable over Kaplan as modified by Ferleger, further in view of Tonooka et al. (US 3,797,965). However, the combination of these references do not teach or suggest every claim limitation. Specifically, these references lack a teaching of a ratio of a maximum thickness of each blade to an average developed length of an average fibre of each blade between 0.1 and 0.2. Further, the references also do not disclose a blade having an average fibre that is oriented, over essentially an entire height of the leading edge, along a straight line so as to form an angle greater than 90° relative to a line (U) defining a direction of rotation of the leading edge of the runner. As discussed above, neither the Kaplan reference nor the Ferleger references teach these claim limitations. The Tonooka reference likewise lacks teachings of either of these claim elements. Tonooka discloses a welded type Francis runner comprising subassemblies which can be assembled together on an installation site by welding. Tonooka is silent regarding a ratio between a maximum thickness of each blade to an average developed length of an average fibre of each blade and to an angle between a line (U) and a straight line

extending from an average fiber. Since Tonooka does not add the claim limitations lacked by the Kaplan and Ferleger references, the combined teachings of these references do not teach or suggest every claim limitation. Thus, withdrawal of this rejection is respectfully requested.

Claims 6 and 8

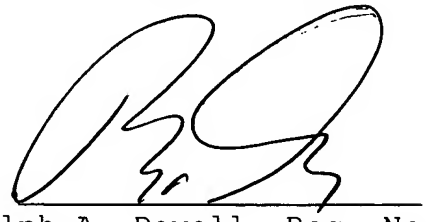
The Examiner has rejected claims 6 and 8 as being unpatentable over Kaplan as modified by Ferleger, as modified by Tonooka, further in view of Dunahoo (US 3,962,506). However, the combination of these references do not teach or suggest every claim limitation. Specifically, these references lack a teaching of a ratio of a maximum thickness of each blade to an average developed length of an average fibre of each blade between 0.1 and 0.2. Further, the references also do not disclose a blade having an average fibre that is oriented, over essentially an entire height of the leading edge, along a straight line so as to form an angle greater than 90° relative to a line (U) defining a direction of rotation of the leading edge of the runner. As discussed above, the Kaplan, Ferleger, and Tonooka references teach these claim limitations. The Dunahoo reference likewise lacks teachings of either of these claim elements. The Dunahoo reference is directed to fiber-reinforced plastic articles of

manufacture having noncircular cross-sections and multi-chambered, cellular constructions. Dunahoo is silent regarding a ratio between a maximum thickness of each blade to an average developed length of an average fibre of each blade and to an angle between a line (U) and a straight line extending from an average fiber. Since Dunahoo does not add the claim limitations lacked by the Kaplan, Ferleger, and Tonooka references, the combined teachings of these references do not teach or suggest every claim limitation. Thus, withdrawal of this rejection is respectfully requested.

In view of the foregoing, reconsideration of the 35 U.S.C. § 103(a) rejection is respectfully requested and favorable consideration and allowance of the claims solicited. Should the Examiner have any questions regarding this response, the amendments submitted herewith, or the allowability of the claims, it would be appreciated if the Examiner would contact the undersigned attorney of record at the telephone number provided below for purposes of facilitating prosecution of this application and for scheduling an interview, if necessary.

Respectfully submitted,

DOWELL & DOWELL, P.C.



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ABSTRACT OF THE DISCLOSURE

A Francis runner and a hydraulic turbine equipped with such a runner, wherein the runner includes a ceiling, a belt, and blades which extend between the ceiling and the belt and which define liquid flow channels therebetween. A ratio (e/L) of a maximum thickness (e) of each blade to an average developed length (L) of an average fibre of each blade is between 0.1 and 0.2. At a leading edge of each blade, the average fibre is oriented, over essentially an entire height of the leading edge, along a straight line (Δ_{23}), which forms an angle (α) greater than 90° relative to a line (U) defining a direction of rotation of the leading edge of the runner.